

Title: Fishy Business

Brief Overview:

In this performance assessment, students will research, design, and create a school aquarium. The students will use knowledge and concepts attained from their experiences with mathematics (focus on geometry), science (focus on oceanography/biology), and language arts (focus on writing to persuade and reading for information). Students will employ cooperative learning strategies to successfully complete this assessment task. This is an active and involved task lasting

Links to Standards:

- **Mathematics as Problem Solving**

Students will demonstrate the ability to solve problems by successfully designing an aquarium within a given budget, using appropriate materials, keeping within dimensional guidelines, recognizing biological factors regarding feeding, maintenance, and habitats of marine organisms.

- **Mathematics as Communication**

Students will use oral, written, and graphic methods to communicate with local organizations, businesses, school personnel, and peers. Means of communication include phone dialogue, business letters, persuasive letters, group discussion, and presentation.

- **Mathematics as Reasoning**

Students will demonstrate the ability to reason mathematically. Students will make choices within given parameters, use spatial sense to analyze placement of objects, and justify their decisions.

- **Mathematical Connections**

Students will make connections between the real-world and this learning experience. Students will be able to incorporate the areas of science, language arts, and art into this activity.

- **Number Concepts & Relationships**

Students will demonstrate their ability to apply estimation strategies in computation. They will incorporate these strategies through use of technology, measurement techniques, and problem solving skills. They will determine the reasonableness of solutions while researching and creating their design. Students will estimate cost in the creation of the aquarium and computation in the analysis of their project.

- **Geometry & Spatial Sense**

Students will demonstrate their ability to apply geometric concepts such as perimeter, area, volume, angles, and 2-dimensional and 3-dimensional shapes through the development and design of their aquarium.

- **Measurement**

Students will demonstrate and apply concepts of measurement using customary standard units. They will estimate and verify measurements. They will apply measurement to interdisciplinary and real-world problem solving situations.

Grade/Level:

5th grade

Duration/Length:

This performance assessment will take 2 - 8 weeks depending upon the extent of participation of other disciplines (science, art).

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Research techniques
- Volume, Area, Perimeter, Angles
- 2-D vs. 3-D
- Make drawings to scale
- Measurement techniques

Objectives:

Students will be able to:

- work cooperatively in groups to accomplish a common goal.
- integrate multiple mathematical concepts.
- identify habitats and needs of marine organisms.
- recall and apply appropriate formulas.
- speak and write to communicate, explain and support their answers and choices.
- use organized lists.
- use calculator skills.
- collect and organize information.
- represent their aquarium in a 2-D or 3-D model.
- write a rough draft, revised draft and final draft of a persuasive letter.

Materials/Resources/Printed Materials:

- calculators
- trade books, journals, resource books
- computer (CD-ROM, Internet)
- LOGO (to print out final product) OPTIONAL
- telephone books for local businesses
- rulers, compasses, protractors
- art supplies (dependent on project)
- graph paper
- telephone access (in school)
- Student Resource sheets
- Teacher Resource sheets
- graphing software OPTIONAL

Development/Procedures:

NOTE: This performance assessment was designed to last anywhere from 2-8 weeks. You may choose to do a few of the activities or the entire unit plus some extension activities. The number of activities you choose to do may be tailored to your classroom needs, time constraints, and budget. This project may be as simple as a pencil and paper research and drafting project, or as elaborate as actually constructing a school aquarium and writing reports on the marine life. As teachers, we are required to be flexible.

This task allows flexibility to meet the needs of you and your students. Activities may be combined, broken down, or even skipped as needed for your class.

- Students will need to be placed in cooperative groups of 3-4 to complete this performance assessment. This may be done before or after the task is presented.
- An activity checklist is provided at the end of the assessment (SR 6). This checklist may be used by you or your students to make sure all parts of the activities that you wish to include are completed. You may modify this list to fit your needs. One good idea may be to provide each individual with their own checklist to be kept in a team or individual folder designated to this assessment.
- A letter to parents is included (see TR 2). This letter informs parents that their child will be involved in a performance assessment task and suggests home activities that will help their child successfully complete the task.
- It is recommended that you have a true-live aquarium set up in the classroom prior to implementing this unit. This will help the students develop a real-world connection to their project.

ACTIVITY 1:

- Pre-select a room in your building to be the future “aquarium.” This should be a room students have easy access to for measuring and visualizing their project.
- Present the task to the students (Teacher Resource 1). This may be done on the overhead and/or handouts.
- Access the students’ prior knowledge about aquariums by creating a class K-W-L about aquariums. Complete K and W now. Save L for the closure of the task.
- As a class, create a class list of the things that will need to be done in order to accomplish this task. Examples of things that should be said are: measure the room, find out about marine life, decide on materials, find out the cost of materials, asking permission, constructing the aquarium (or making a 2-D or 3-D model).

ACTIVITY 2:

- Students will need rulers, tape measures, meter sticks, graph paper, and pencils to complete this activity. Team member roles should be set prior to the onset of this activity.
- Teams should be given the opportunity to go to the selected room to measure the perimeter and area of the room (floor and walls). This information should be recorded on graph paper with one square equaling one standard unit of measure (i.e., foot, decimeter, meter). Students should have five sheets of graph paper drawn on, one for the floor and one for each wall face. It may be helpful to have the height of the room measured beforehand. * if this is too complicated, students may only want to do the floor plan.
- As teams return to the classroom, they should begin working on the design of their aquarium. Things to keep in mind include the shape of the tanks, walkways for visitors, number of tanks, guides, souvenir or information stands, etc.
- Each team should have a rough draft of their design by the end of this activity. Area and perimeter measurements should be noted on their draft. NOTE: If you have the software program LOGO, this may be done on the computer.

ACTIVITY 3:

- As a class, brainstorm materials which are needed to construct an aquarium. Web or chart student responses.
- Tell the student what the budget is for their project. You should determine the budget for your class. This will be based on the size of the room chosen for the project. If you use the price list provided (SR 1), a reasonable budget for a small classroom may be \$1,000.

- In their groups, have the students decide which materials would be necessary to construct their aquarium. Students should choose materials that are suitable for their design and fall within the given budget.
- Teacher Choice: Students are now either given Student Resource 1 with materials and prices provided, or Student Resource 2 with a blank chart for recording materials and costs based on phone calls to local stores.
 - Student Resource 1: Students use this sheet to calculate their total cost. Use of calculators is recommended.
 - Student Resource 2: Students will list their materials in the appropriate space, use a phone book to locate local retailers (hardware stores), call the stores to get price quotes, graph the results to help them make an informed decision based on total cost and quality. A blank graph is provided (SR 3).
- Each team should have a complete itemized list (item and cost) of the materials they have chosen for their design.
- Each team needs to write an explanation justifying why they chose the materials they did and how they know they determined the amounts to purchase. Explanations should be clearly written and explain their reasoning.

ACTIVITY 4:

- Students will research marine life to determine which species would be appropriate for their aquarium. Factors to keep in mind include:
 - the size of the tank required for the species' habitat (volume of water)
 - natural enemies/predators of species (keep them separated!)
 - vegetation
 - feeding and maintenance requirements
- Students may do research at the school library, public library, through the Internet, etc.
- Student Resource 4 provides a chart for students to record data. Teams will be required to choose at least 4 different species. Each team member will be required to research and provide research results for one of the four species.
- Based on the research, teams need to strategically place the species in their tanks of their aquarium.
- Possible art connections include: paper mache models of the species, watercolor illustrations, picture books/stories, etc.

ACTIVITY 5:

- Based on the student's work in Activities 1-4, teams should do a final copy of the floor/wall plan for their aquarium (rough draft was completed in Activity 2).
- Teacher's Choice: At this time, students may either continue to Activity 6, OR create a 3-dimensional model of their aquarium. Examples of materials: cardboard and saran wrap, poster board, wood and plastic, tooth picks and clay, shoebox and construction paper, etc.

ACTIVITY 6:

- At this time, students will be writing a letter to persuade their principal to approve their project. See Teacher Resource 3 for the writing prompt and Teacher Resource 4 for the rubric. Students should be required to write a rough draft, complete the peer revision sheet (Student Resource 5), and submit a final draft of the letter along with their project design.

ACTIVITY 7:

- Teams may present their projects to the class at this time. Presentations may include any AV equipment available, any aspect of the project, and a short question and answer period at the end. Criteria for public speaking could be set up and possibly evaluated by teacher/peers (eye contact, voice projection, word choices, etc.). An evaluation sheet is provided for teacher use (TR 5).
- Display the projects.

Performance Assessment:

This entire project is a performance assessment task. Below is a list of assessments that should be made throughout the project:

Activity 1: Informal Observation, Participation

Activity 2: Teacher observes cooperative group interaction and individual participation. Each group must complete the rough draft of their design with accurate measurements of perimeter and area clearly labeled.

Activity 3: Cooperative group interaction, accurate calculations on materials list, clearly written justification for their decisions.

Activity 4: Cooperative group interaction, individual work habits, successful completion of marine life chart, using clear ideas to share research results with group members, successful placement of species in tanks.

Activity 5: Accurate final copy of floor plan and/or project submitted

Activity 6: See rubric (Teacher Resource 4)

Activity 7: Effective class presentation, see Teacher Resource 5.

Extension/Follow Up:

- Schedule a field trip to a local aquarium (for example, National Aquarium in Baltimore).
- Elicit guest speakers from local aquarium, pet store, nature center, architect firm, or construction company.
- If resources allow, build the aquarium and gather supporters.
- Publish pamphlets encouraging respect and care for marine life.
- Schedule a field trip to local hardware store, home improvement center, or lumber yard.

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Task

TR 1

Our school has been selected by the National Aquarium to participate in a nationwide program. The purpose of this program is to provide communities with an opportunity to experience and build an appreciation for marine life. Every school selected has been asked to convert one room in their building into a community aquarium. Our class has been selected to research and design this aquarium.

We will be working in teams of four students to create possible designs for this project. Teams will be provided with a budget and need to make decisions about the building materials to be used. Teams will also need to research which marine life will be best for the exhibition and how the needs of the marine life will be met.

Your teacher has been trained by the National Aquarium to lead this project. He or she will guide you through the steps needed to complete your project. Good luck!!!

Letter to Parents

TR 2

Dear Parents,

This letter is to inform you that your child will be participating in a performance assessment task for the next ____ weeks. In order to successfully complete this task, your child will be asked to use many mathematical concepts, writing skills, and research techniques which they have experienced so far this year. Below is a list of home-activities which you may choose to complete with your child. These activities will reinforce concepts which will help your child perform to the best of their ability.

Sincerely,

- * Estimate and calculate the amount of water it takes to fill the bathtub, a spaghetti pot, a mug of cocoa, a dog dish, etc. (Concept: Volume).
- * Estimate and calculate the distance around your yard, rooms in the house, furniture, trees, dishes, etc. (Concept: Perimeter/Circumference).
- * Estimate and calculate the amount of carpet to cover a room, the amount of grass mowed, the amount of paint to cover a wall, etc. (Concept: Area).
- * Estimate and measure in different units distance between TV and couch, cat dish and litter box, mailbox to front door, etc. (Concept: Measurement Skills).
- * Estimate and calculate the cost of items in a supermarket, the cost of dinner at McDonald's, cost of a trip to Disneyworld, cost per mile of driving, etc. (Concept: Money).
- * Make a diorama of a favorite story in a shoebox, build a model car or airplane, build structures with Legos, etc. (Concept: 3-Dimensional Visualization).
- * Read books or watch programs/videos about marine life.

Writing to Persuade Prompt

TR 3

Your principal must give final approval for use of the school room and construction of the project. Now that you have completed the research and design of your aquarium, write a letter to the principal persuading him or her to approve your project.

Make sure you include a strong topic sentence, at least three supporting details, and a conclusion. You need to convince your principal that your design is the best and makes the most efficient use of the space. You must submit a copy of your design with this letter. This will allow the principal to make a more informed decision.



Writing to Persuade Rubric

TR 4

4 points

- Written work is clearly presented with at least three supporting details; has correct form, spelling, punctuation, and grammar.
- Demonstrates logical reasoning.
- Completed design is submitted.

3 points

- Written work is clearly presented with at least three supporting details; has only three of the following: correct form, spelling, punctuation, and grammar.
- Demonstrates logical reasoning.
- Completed design is submitted.

2 points

- Written work is presented with at least two supporting details; has at least two of the following: correct form, spelling, punctuation and grammar.
- Demonstrates logical reasoning.
- Completed design is submitted.

1 point

- Written work is presented with at least one supporting detail; has at least one of the following: correct form, spelling, punctuation and grammar.
- Demonstrates basic reasoning.
- Completed design is submitted.

Non-Scorable Response

- Work is illegible.
- No work is completed.
- Student was off-task or off-topic.
- No design is submitted.

TR 5

Grading Key:

- 2 - Consistently displays competence in this area.**
1 - Frequently displays competence in this area.
0 - Seldom or never displays competence in this area.

Aquarium Materials and Prices

SR 1

*** The National Aquarium will be providing your school with supplies necessary to maintain marine life. For example, water, filters, food, plants, sand/gravel, animals, lights, heaters, etc. Your job is to design and construct the tanks and walkways.

Materials

Current Price

Fiberglass.....	\$5.00per squarefoot
Glass.....	\$3.00per squarefoot
MetalSheets.....	\$6.50per squarefoot
MetalStrips.....	\$0.75per foot
Plexiglass.....	\$4.50per squarefoot
Rubber.....	\$1.00per foot
Tile.....	\$1.25per squarefoot
WoodSheets (plywood).....	\$4.00per squareyard
WoodStrips (2x4).....	\$0.60per foot



Caulk.....	\$2.00per tube (covers30 sq ft)
Glue.....	\$1.75per bottle(“ 25 sq ft)
Nails.....	\$1.65per 100
Screws.....	\$3.30per 200

“You Make the Call!”

SR 2

Store #1:_____

Store Name

PhoneNumber

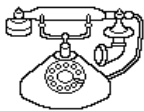
Store #2: _____


Store Name

PhoneNumber

Store #3: _____

Store Name

PhoneNumber

	Store 1	Store 2	Store 3
 Materials	Cost	Cost	Cost

[illegible]

Comparison Graph for Store Prices

SR 3



MARINE LIFE DATA SHEET

SR 4

SPECIES

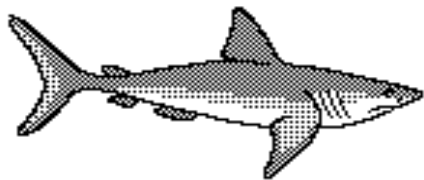
SPACE
REQUIRED

FOOD

NATURAL
ENEMIES

ASSOCIATED
VEGETATION

OTHER INFO



PEER RESPONSE FORM

SR 5

WRITING A PERSUASIVE LETTER

Author _____

Partner _____

Topic _____

Did I include a strong topic sentence which clearly stated my opinion? What is my opinion?

What are three supporting statements I made to support my topic sentence?

I checked for form_____	<input type="checkbox"/>
I checked for spelling_____	<input type="checkbox"/>
I checked for punctuation_____	<input type="checkbox"/>
I checked for grammar_____	<input type="checkbox"/>
I checked for capitalization_____	<input type="checkbox"/>

“Fishy Business” Checklist

SR 6

This sheet will help you make sure you have completed all parts of this task. Your teacher will tell you which parts you are responsible for completing.

ACTIVITY 1

- ☐ I participated in creating a class chart about building aquariums.

ACTIVITY 2

- ☐ I worked with my team to measure and calculate the perimeter and area of the room which will be used for the aquarium.
- ☐ I worked with my team to design our aquarium.
- ☐ My team and I completed a rough draft of our design.
- ☐ (Optional) We used LOGO to create a computer draft of our aquarium design.

ACTIVITY 3

- ☐ I worked cooperatively with my team to choose building materials for our aquarium.
- ☐ I used SR 1 to calculate the prices of our materials and made sure the total fit in our budget.
- ☐ I used SR 2 to contact local businesses and find out material cost.
- ☐ I graphed the data of my team's price research and compared the results.
- ☐ My team and I cooperatively wrote a clear explanation justifying why we chose the materials we did.

ACTIVITY 4

- _____ I researched a species of marine life to find out about their needs.
- _____ I shared my information with my group and we decided where to place our species in our aquarium.
- _____ (Optional) I completed an art project related to my species.

ACTIVITY 5

- _____ My team and I completed a final copy of our floor/wall plan.
- _____ (Optional) I worked with my team to create a 3-dimensional model of our aquarium design.

ACTIVITY 6

- _____ I wrote a rough draft of a persuasive letter.
- _____ I used SR 6 to revise another team member's draft.
- _____ I had another team member revise my draft.
- _____ I submitted a final draft along with our team's project design.

ACTIVITY 7

- _____ I participated in a team presentation of our aquarium design to the class.
- _____ I was attentive during other team's presentations.